ENGINEERING OPPORTUNITIES

A Handbook on Successful Engineering Careers



With a Foreword by

PROFESSOR

A. M. LOW

ENGINEERING OPPORTUNITIES

General Prospectus

of

The British Institute of Engineering Technology

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North American Headquarters

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Constitution

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Winner of Research Scholarship, London University. An advanced scholar, specializing in Engineering Science.

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A Civil Engineer of wide practical experience. Specialist in Contracts and Specifications. The examination successes resulting from his individual efforts are remarkable, and testify to his unusual abilities.

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A practical Mechanical and Electrical Engineer and Designer of wide experience, who now devotes his time to imparting his knowledge and experience to B.I.E.T. students. Mr. Magill's services are an acquisition of which any educational centre would be proud.

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A Mechanical Designer with wide Drawing Office and Administrative experience. A teacher with unassuming but highly successful methods.

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A Mechanical Engineer who has specialized in Workshop Production, Organization and Management. An enthusiast who makes his students' success his hobby.

W. L. Horwood, B.Sc. (Hons.) (Eng.) (Lond.).
An Electrical Engineer with a brilliant record. Author of "Electrical Technology." Since gaining remarkable success at College has specialized in correspondence tuition. A large number of students owe their early examination success to his painstaking care.

E. Jones, B.A., Teacher's Diploma.
Has devoted his life to teaching English Literature, Languages and Economics. A gifted writer and one of the early pioneers of correspondence education.

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A mathematician and physicist of exceptional ability who has successfully coached hundreds of candidates for Professional Examinations. Perhaps one of the coming physicists of the century.

W. J. Robinson, B.Sc. (Hons.) (Eng.), A.M.I.Mech.E., A.M.I.C.E.
Had a brilliant college career, securing First Class Honors. This, together with his subsequent varied practical experience, has made him an ideal tutor in mechanical engineering.

L. A. Parslow, B.Sc. (Lond.), Teacher's Diploma (Lond.).
A mathematician who can really teach his subject, without stifling the student with too academic an atmosphere.

H. W. Sims-White, F.R.Met.S., A.R.Ae.S.I., Memb. Coll. Prec., A.I.L.
Has had extensive practical and teaching experience in this country and abroad in Aeronautical Engineering, Navigation and Meteorology. Certified linguist.

E. H. N. Augier, A.C.G.I.

A civil engineer with vast experience at home and abroad on roads and railway engineering. An expert on modern developments.

H. Roth, B.Sc. (Hons.) (Eng.) (Lond.).

Aeronautical Engineering expert. Is well abreast of the latest developments, and places his knowledge at the unreserved disposal of our students.

A. Schofield, F.S.I.

First place, Intermediate; First place, Final, Examinations of the Surveyors' Institution. Penfold Silver Medal. Driver Prize. Penfold Gold Medal. Crawter Prize. A specialist and expert in Valuation for all purposes.

C. E. Kenney, F.S.I.

The well-known quantity surveyor. Has had extensive experience on large Public Buildings and projects.

H. H. Laws, A.R.I.B.A.

A practical and theoretical expert in building construction and design. Has had a wide and varied experience in preparing many important plans and supervising large contracts.

W. H. Hutchinson, P.A.S.I.

Specialist in building, specifications, estimating, sanitary science. Has an extensive and sympathetic knowledge of students' requirements.

C. A. Andrews, A.A.I.

Specializes in teaching the higher branches of Auction work.

P. C. Roylance (B.Sc.) (Economics) (Hons.), A.C.A.

Has had wide experience with correspondence tuition. An expert tutor in economics and accounts as required for the professional examinations.

G. L. Hunt, B.Sc. (Eng.) (Lond.) A.C.G.I., D.I.C., A.M.I.E.E.

An expert on the design and manufacture of electrical machinery.

W. F. Jones, B.Sc. (Lond.), A.M.I.W.T.

Advanced research worker in wireless technology. Specializes in the correspondence teaching of physics and applied electricity.

M. Salmons, M.Sc., Teacher's Diploma.

Specialist in English Literature and History, and educational subjects.

Monsieur A. Questiau.

A linguist who, having lived in this country for many years, views his subject from the English standpoint and has thus developed the happy gift of anticipating the English students' difficulties in studying French.

A. B. Cooper, A.I.L. (Certified Linguist).

An Englishman who is an accomplished linguist. Specialist in French, Spanish and German.

G. L. Jones, B.Sc. (Hons.) (Eng.) (Lond.), A.R.S.M., A.I.C.

A late acquisition to our tutorial staff, considerably strengthening our Mining and Metallurgy Depts.

J. B. C. Barnard, B.A. (Hons.) (Lond.).
An authority on English literature and its requirements by Professional Institutions.

F. W. Goodman, B.A. (Lond.).
A brilliant English scholar with an uncommon gift of imparting a knowledge of this subject to the technically trained mind.

H. R. Tyrrell, B.Sc. (Eng.), A.I.N.A., A.M.I.Mar.E.
Responsible for marine engineering, workshop practice and production engineering studies.

W. Du C. Bowron, B.Sc. (Eng.) (Hons.).
Special subjects: Telegraphy, Telephony and Wireless Engineering.

P. G. Forward, A.M.I.Mech.E.
Specialist in die and press tool work and general production engineering.

G. A. Yeates, B.Sc. (Eng.) (Lond.).
Specialist in line communications and electrical machine design.

R. E. C. Dorling, B.Sc. (Eng.) (Lond.).
Civil Engineering Tutor. Formerly engaged on research work at the National Physical Laboratory.

E. J. Pryor, A.R.S.M., A.I.M.M.
An authority on General and Gold Mining with extensive colonial experience.

Philip Kemp., M.Sc. (Tech.), M.I.E.E., A.I.Mech.E., Mem. A.I.E.E.
The eminent electrical engineering consultant and author of many well-known standard textbooks.

L. L. Laurie, M.Sc. A.I.C.
A brilliant scholar; specialist in Pure and Applied Chemistry.

R. G. Hoare, B.Sc. (Hons.) (Eng.).
Research worker in Mechanical Engineering and Internal Combustion Engines.

J. L. Dixon, B.Sc. (Glas.), Civil Eng. A.M.Inst.C.E.
A Civil Engineer of high standard in the British Isles, and specialist in Structural Steelwork and Reinforced Concrete Design. An authority on Irrigation in the Near East.

J. D. Dennison, A.M.I.E.E., D.L.C.
An authority on Electrification and Practical Electricity problems. Concentrates on Line Communications, Telegraphy and Telephony.

F. B. Cope, B.Sc. (Eng.), Grad. I.E.E.
Expert in Radio Engineering, and writer on the most up-to-date developments in the subject.

W. A. Griffett, P.A.S.I.
A Quantity Surveyor of high repute, responsible for some important Local Government work. Has extensive experience in Town Planning and Sanitation.

Supported by many lecturers of leading Polytechnics and Technical Colleges, authors of well-known technical works and members of prominent Engineering Societies.

Foreword

BY

Professor A. M. Low

D.Sc., Ph.D., A.C.G.I., M.I.A.E., F.C.S.,
F.I.P.I., F.R.A., F.R.G.S., F.G.S.

Professor Low is the celebrated Inventor and Engineering Consultant. His high opinion of the merits of the B.I.E.T., given in this foreword, will indicate, in some small measure, the high esteem in which the Institute is held in all quarters.

Engineering should be considered of highest rank among the professions. No engineer need apologize for his calling. He should feel the greatest pride in it, for it may be said that it is the very heart and soul of material progress.

Engineering is certainly the foremost industry in this country today, and yearly accounts for the expenditure of many millions of dollars. Since the period of the eighties, when the national movement of industrial development was inaugurated in Canada by the construction of the great transcontinental highway, the Canadian Pacific Railway, Canadian engineering has steadily forged ahead. The expansion of railway and transportation facilities in Canada led ultimately to the development of the great wheat fields of Alberta, Saskatchewan and Manitoba, and also contributed materially to the development of the mining regions and the pulp and paper manufacturing industry. Canada has made great progress in agriculture and grain milling, in mining, transportation, and the development of water-power and irrigation.

The superiority of British, Canadian and American engineering is still unchallenged, but with the wonderful opportunities which constantly present themselves, it is astonishing to find how many men engaged in lesser paid engineering positions have the impression that they cannot escape from the thraldom of the category "skilled workmen" or other time-paid occupations.

Nothing more completely erroneous could possibly be imagined.

In the course of my consulting and research duties I am very often in contact with some of our largest engineering employers, and it is made overwhelmingly evident to me that if only those men in their shops and on their drawing boards would but decide to study ahead of their work, their opportunities and earning power would be magnified out of all proportion to the time and expenditure necessary for securing the vital qualification of technical knowledge.

I cannot believe that it is merely a lack of ambition which prevents such men from making a determined effort to leave the hard trodden paths of labour. I know full well that every man has his storehouse of ambition, and that it is only the lack of proper guidance and sympathetic encouragement which holds him, metaphorically, to the grindstone.

The British Institute of Engineering Technology was inaugurated with the sole purpose of helping the ambitious engineer to make progress. The Canadian Institute of Science and Technology was formed to give North American students of the B.I.E.T. the unique advantage of having men intimately versed in Canadian and American conditions, counsel them on their future careers. All courses have been prepared to give practical men the technical knowledge which is essential before they can hope to leave the environment of the bench and workshop.

Benefit from the lessons and training of the Institute is received at the very beginning, for the student is taught to progress from first principles, if necessary, in a systematically interesting manner which gives him a thorough grasp of the technical side of his work.

The help given by the Institute is not restricted to students of any particular age or educational attainments, for each course is so prepared as to be adapted to the individual requirements of any student.

It is unnecessary that I should enlarge upon the varied details of the methods employed or upon the benefits which the student receives, for these are explained in detail elsewhere in this book. I would mention, however, that it is the aim of the B.I.E.T. to prepare every student ultimately for an engineering examination of recognized standing.

The "general" courses of instruction have been designed with this end in view, and constitute ideal stepping-stones to the more advanced "examination" courses.

In all too many instances tuition by correspondence has been undertaken with an entire lack of sympathy and consideration for the student; but **it is my considered opinion that the methods employed by the British Institute of Engineering Technology are in advance of any similar services offered to engineers.**

I am certain that, with ordinary intelligence and a reasonable mixture of ambition and determination, it is an easy matter for those who are engaged upon any branch of engineering work to improve their lot and increase their earning capacity materially.

Throughout the association of the student with the B.I.E.T. he receives individual attention and assistance; as his studies proceed he is made to see clearly the goal he has in sight, and how a well-paid engineering appointment will result.

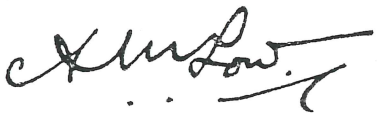
The student is not made to study unwanted material which has no definite value in the engineering employment market. He is given the essentials of important training in an interesting manner, and as quickly as is compatible with efficiency. The Tutors of the Institute are practical enthusiasts, ready and willing to give special attention and advice to students who may encounter difficulties connected with their studies or work.

It is the foremost object of the B.I.E.T. that definite help and sound guidance shall be given to each and every student.

The average engineer today has been content to follow in the wake of technically trained men, and has never followed his own impulses towards achievement by home study. Opportunities cannot be stored in pigeon-holes. Practical knowledge alone is of little use unless it is accompanied by an understanding of the basic principles underlying the operation.

The British Institute of Engineering Technology can definitely help towards the obtaining of a better position for every student, and can bring within his reach the opportunities for advancement, which alone are obtained by technical training.

I consider that the work of The British Institute of Engineering Technology commands the greatest respect. I unreservedly recommend the Institute to all who wish to prepare for an Engineering Examination or one of the higher paid Engineering appointments.



The foregoing foreword was written by Professor Low prior to his acceptance of the Principalship of the Institute. It was only after he had had every opportunity of studying the Institute's methods, over a period of many years, that he expressed his willingness to become Principal. He writes:

"It is with very great pleasure that I accept the appointment of Principal to the British Institute of Engineering Technology. During my many years' association with the Institute as Technical Consultant, I have had every opportunity of studying the methods laid down by the founders, and by accepting the Principalship I feel I am merely endorsing the view I originally put forward, namely, that the B.I.E.T. tutorial organization is considerably in advance of any similar service offered to engineers."

Examinations Held by The Institution of Mechanical Engineers

The *A.M.I.Mech.E.* qualification hardly needs introduction. It is probably the best known qualification in the engineering world.

The large majority of mechanical engineers holding responsible positions have the letters *A.M.I.Mech.E.* attached to their names, a fact which surely indicates the value of this qualification. The A.M.I.Mech.E. Examination appeals to every type of mechanical engineer owing to the wide range of optional subjects allowed in Section B. We need simply add that the A.M.I.Mech.E. qualification is recognized throughout the civilized world as the hall mark of the thoroughly qualified mechanical engineer, and a man holding it need never worry about the future—his future is assured.

The Institution of Mechanical Engineers holds two examinations, namely, *Preliminary* and *Associate Membership*.

The Examinations are held in Canada once annually in October.

Common Preliminary Examination Course

(Held by the Engineering Joint Examination Board)

The Common Preliminary Examination which takes the place of the former Studentship Examination held by the I.Mech.E. may be taken between the ages of 16 and 25 years. **Candidates of 20 years of age may, however, take the Associate Membership Examination direct in place of the Common Preliminary.** It should be noted that a pass in the Common Preliminary entitles the candidate to exemption from the English paper in Section "A."

Subjects

1. **English, including an Essay and General Knowledge.**
2. and 3. **Mathematics (two papers).**
 - (a) Arithmetic and Algebra.
 - (b) Practical and Theoretical Geometry and Elementary Trigonometry.
4. and 5. **Two of the following subjects:—**
 - (a) Elementary Mechanics.
 - (b) Elementary Physics.
 - (c) Elementary Chemistry.
 - (d) A language other than English (selected from Latin, French, German and Spanish).

(NOTE.—It is not essential that the candidate should present a foreign language in this Examination.)

Graduateship

(G.I.Mech.E.)

Candidates for Graduateship must be between the ages of 21 and 30 years, and must have passed Sections "A" and "B" of the Associate Membership Examination. A Graduate must pass Section "C" before being transferred to the class of Associate Membership.

Associate Membership Examination

(A.M.I.Mech.E.)

An Associate Member of the Institution of Mechanical Engineers must be at least 25 years of age. It should, however, be clearly understood that *it is not necessary to attain this age before sitting for the A.M.I.Mech.E. Examination,* as candidates over 20 years of age may take the Examination. If they pass Sections "A" and "B" they may apply to become Graduates (G.I.Mech.E.), and having also passed Section "C" they will not be required to take any further Examination when applying for Associate Membership.

Candidates who have passed the Examination before they are 25, although unable to become Associate Members of the Institution of Mechanical Engineers, will be able to show that they have *passed* the A.M.I.Mech.E. Examination, which is an outstanding hall-mark of efficiency and must result in their advancement.

Every Mechanical Engineer, whatever his age, should make the A.M.I.Mech.E. qualification his ultimate aim, although it might first of all be advisable to take our General Mechanical Engineering Course. Advice on this matter will be willingly given. It should be noted, however, that our A.M.I.Mech.E. course is quite complete in itself and can commence from very first principles if necessary. Accordingly, large numbers of students take this course, not only with the object of studying up to A.M.I.Mech.E. standard, but also of obtaining a first-class Mechanical Engineering training. The course is so comprehensive and opens up so many possibilities to the ambitious man, that it has our strongest recommendation.

Special Mechanical Engineering

or

A.M.I.Mech.E. Examination Course

(NOTE.—This Course has been specially prepared to cover the A.M.I.Mech.E. Examination.)

Section "A" (Six Papers.)

(a) English.
(b) Mathematics.
(c) Applied Mechanics (including Strength of Materials.)
(d) Engineering Drawing.
(e) Two of the following:—
(1) Applied Heat. (2) Principles of Electricity. (3) Physics. (4) Chemistry. (5) Workshop Technology.

Section "B".

(Three subjects only are to be taken.)

(a) Theory of Machines.
Kinematics; cams; gears; kinetics; gearing; balancing; vibrations; gyroscope; friction and lubrication.

(b) Properties and Strength of Materials.
Stress and strain; cylinders; beams; torsion; combined stresses; strain energy; springs; struts; properties of materials; testing of materials.

One paper only to be taken from the following:—

(1) **Heat Engines I—Steam and the Steam Engine.**

Properties of steam; thermodynamics; boilers; reciprocating steam engines; valves and valve gears; turbines; condensers; refrigeration; heat transmission; constructional details.

(2) **Heat Engines II—Internal Combustion Engines.**

Cycles; properties of liquid and gaseous fuels; classification of engines; combustion in engine cylinder; testing and performance; constructional details; air compressors; heat transmission.

(3) **Hydraulics and Hydraulic Machinery.**

Physical properties of fluids; orifices and weirs; fluid motion in pipes and channels; measurement of rate of flow; impact of jets; vortices; hydraulic turbines; pumping machinery; hydraulic mechanism; principles of similarity.

(4) **Electrotechnology.**

Effects of current; voltage; the electric circuit; energy and power; magnetic effects; electrostatic effects; alternating currents; elementary treatment of A.C. circuits; sources of supply; motors; the transformer; the rectifier; systems of supply; supply and control arrangements; electric lighting; special applications; safety precautions.

(5) **Metallurgy.**

Metallography; iron and steel; non-ferrous metals; heat treatment of metals; heat treatment plant and equipment; technology of working processes; press work; welding.

(6) **Aeronautics** including aerodynamics and aircraft design.

(7) **Metrology and Machine Tools.**

Section "C".

Industrial Administration

Industrial development; formation and development of manufacturing organizations; sales organization; design organization; production organization; factory layout; factory sites; management; labor; industrial legislation; the Factories Act; Workmen's Compensation Acts.

Fees

Common Preliminary Examination course, $80 cash, or $100 payable $7.50 on enrolment and $7.50 a month.

Associate Membership Examination course (Sections "A", "B" and "C"), $160 cash, or $180 payable $7.50 on enrolment and $7.50 a month.

The above fees include all books, tuition, Guarantee, and intensive pre-examination coaching.

The fees for the combined Preliminary and Associate Membership Course are $200 cash, or $220 payable $10 on enrolment and $7.50 a month.

On successful completion of our A.M.I.Mech.E. course, the student is awarded our Advanced Diploma and is elected to full membership of the Institution.

General Mechanical Engineering Course

The most important feature of this course is its elasticity. It has been carefully planned to embrace every class of worker in the mechanical engineering industry. The course includes sections in every main branch of mechanical engineering and the student may make his own choice of subjects from Section "B" which will dovetail into his particular requirements. The student may take Section "A" of the course and two or more subjects from Section "B".

Section "A"

1. **Practical Mathematics.**
 Only such lessons in this subject, written in a simple and attractive manner, are given as are absolutely essential for a thorough and intelligent study of the subjects.
2. **Applied Mechanics.**
 Matter, force, weight, triangle and polygon of forces, structures, moments, centre of gravity, stress, strain, elasticity, tension, compression, shear, beams, riveted joints, shafts, springs, work, mechanical advantage, velocity, ratio, energy, power, machines and mechanisms, friction, velocity and acceleration, kinetic energy, horse-power, transmission of motion and power, dynamometers, flywheels, momentum, centrifugal force and pumps, governors, hydraulics, materials.

Section "B"

Optional Subjects

1. **Heat and Heat Engines.**
 Heat. Thermometry. Expansion. Transmission of heat. Properties of steam. Steam tables and uses. Combustion and fuels. Historical development. Boilers and fittings. The steam engine. Details. Efficiency and performance. Motion of piston and crank. Flywheel and governor. The slide valve. Steam turbines. Condensing engine. Internal combustion engines. Otto and Diesel cycle. Ignition. Gas engines. Oil engines.
2. **Machine Construction, Drawing and Design.**
 Plane geometry, principles of projection. Riveted joints. Screw threads. Nuts and bolts. Joints and connections. Keys. Pipes and joints. Shafting and couplings. Bearings. Roller and ball bearings. Pulleys. Cranks and crankshafts. Eccentrics. Connecting rods. Crossheads. Locomotive details. Pistons. Engine cylinders. Valve gear. Stop valve. Safety valve. Steam engine, complete. Boiler details. Pump details. Gas engine. Gasoline engine details. Miscellaneous details. Lathe details. Chuck. Governor. Gear wheels.
3. **Machine Tools and Workshop Practice.**
 Measurements and measuring machines and tools. Gauges and gauge systems. Workshop tools. Bench work. Fittings. Materials. Heat treatment. Soldering, brazing, etc. Lathes. Tool holders. Lathe tools, speeds and feeds. Lathe accessories. Turning. Screw and screw cutters. Turrent and Capstan lathes and tools. Plain and universal milling. Gears and gear cutting. Gear hobbing and planing machines. Boring and slotting machines. Planing, shaping and drilling. Grinding. Forging. Transmission.
4. **Fitting and Erecting.**
 Tools, chisels, hammers, files, scrapers. Screwing tackle. Keys, cotters and pins. Case-hardening. Screws, bolts and nuts. Measurement. Templates and jigs. Materials. Lining out. Chipping, filing and drifting. Adjustments. Gears, shafting, belts and ropes. Joints and packing. Lifting. Repairs. Fitting and erecting shops. Tables.
5. **Engineering Inspection.**
 Objects of inspecting. Receipt and storage of material. Material tests and specifications. Inspection of raw materials. Inspection of partly-finished material. Inspection of finished material. Gauges and measuring instruments. Machine shop inspection. Fitting and erecting shop inspection. Final tests. Repairs, rectifications and obsolete parts. The human element. Tables.
6. **Commercial Engineering and Works Management.**
 Division of costs. Labour. Direct and indirect costs. Materials. Specification of Materials. Tests. Wages system and rates. Shop organization and management.

Time fixing. Speeds. Analysis of various tools and operations. Hand operations. Inspection of work. Classes of fit. Establishment changes, various systems. Reserve, maintenance and depreciation. Selling expense. Railway rates. Shipment. Cost-keeping. Labour costs. Time cards. Material costs. Books. Examples of costing system. Foundry costs. Estimating. Specifications.

7. **Ironfounding.**
Principles. Sands and their preparation. Iron. Melting and testing. Cupolas, blasts and ladles. The shops and their equipment. Moulding boxes and tools. Shrinkage, curbing, fractures, faults. Green sand moulding. Examples. Dry sand moulding. Cores. Loam work. Machine moulding. Machines. Machine-moulded gears. Economics. Weights of castings.

8. **Pattern-making.**
Pattern-makers and pattern-making. Some methods. Lumber. Varnish. Miscellaneous materials. Bench and its attachments. Hand tools. Bench work. Machine tools for pattern-making. The band-saw. The circular saw. The lathe. Fillets. Stave work. Cant or segment work. Patterns for belt pulleys. Patterns for cable pulleys. Making patterns for chain wheels. Patterns for steam cylinders. One way of making a crosshead. Making gear patterns. Propeller wheels. Patterns for screws. Traction wheels for farm engines. Globe valve patterns. Projection. Metal patterns. Common practice. Stripping plate job. A vibrator plate pattern. The evolution of the globe valve core box. Multiple core boxes. Cost of patterns. The marking and record patterns. Pattern accounts.

Fees

Minimum fee for this course, including all Section "A" and any two subjects from Section "B", $120, payable in instalments of $7.50 on enrolment and $7.50 a month, or $100 cash.

Any additional subjects from Section "B" may be taken, when $35 for each additional subject will be added to the fee if paid in instalments, or $27.50 for each extra subject if paid cash.

Fee for Complete Mechanical course (10 subjects),
$180 cash, or $200 payable in instalments.

The above fees include all books, lessons, instructions, Guarantee, etc.

NOTE:—Our Diploma (A.M.I.E.T.), will be awarded to the student completing Section "A" and any TWO subjects from Section "B".

Mechanical Drawing and Design Course

This is an ideal course for the draftsman or for the man who wishes to enter one of the higher branches of the engineering professions via the drawing office. In addition to textbooks, lessons, etc., the student receives a complete set of *Blue Print Working Drawings*, which are invaluable for future reference purposes.

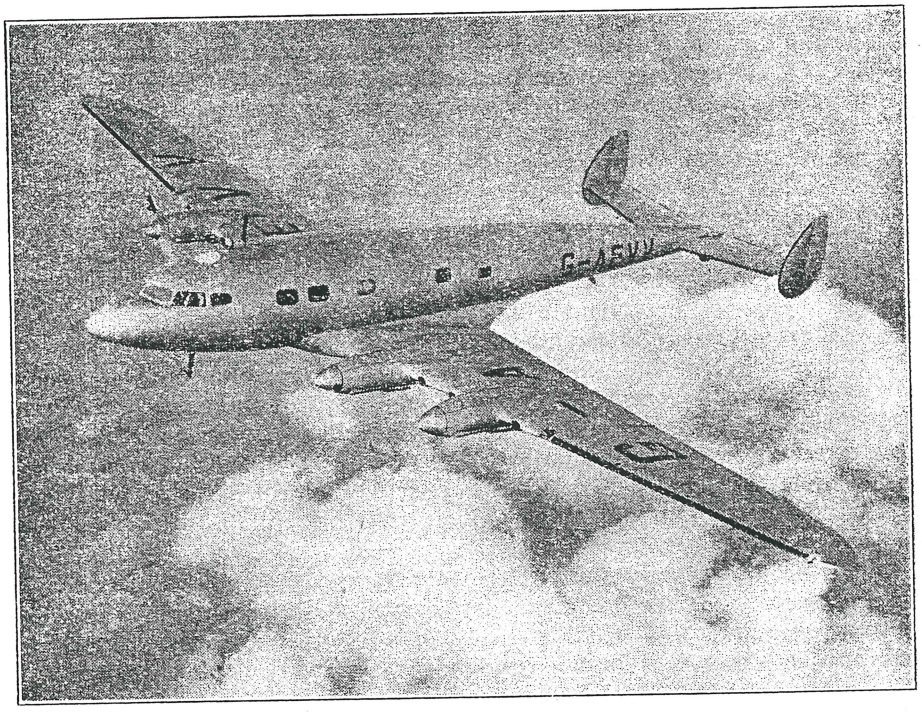
The course is in two sections—Section "A" dealing with fundamental subjects and general principles and mechanical details, and Section "B" consisting of three specialized sections. Students take Section "A", and choose their desired specialized subjects from Section "B". (All subjects may be taken at an attractive fee, as shown below.)

Section "A"

1. **Practical Mathematics.**
Sufficient lessons in this subject are given to enable the student to make a successful study of subsequent sections of the course, and to perform any calculations necessary.

2. **Applied Mechanics.**
Matter, force, weight, triangle and polygon of forces, structures, moments, centre of gravity, stress, strain, elasticity, tension, compression, shear, beams, riveted joints,

Aeronautical Engineering Groups



Courses

A.F.R.Ae.S. Examination.

Air Ministry Exams. for Ground Engineers.

General Aeronautical Engineering.

Advanced Aeronautical Engineering and Aeroplane Design.

Aero Engines Course.

Pilots' "B" License.

Air Navigators' Certificates.

Aeronautical Engineering

Efforts towards mechanical flight have been made ever since Leonardo da Vinci invented the parachute, but nothing practical was achieved until the development of the Steam and Internal Combustion Engine brought forth such experimenters as Sir Hiram Maxim Langley, Lillienthal, and the Wright brothers. Even then, it was not until December, 1902, that the Wright brothers succeeded in producing a machine which carried a full-grown man, and took off and flew under its own power.

Without exaggeration, therefore, it may be said that the science and application of Aeronautics are still in their infancy. Looking back on the progress of aviation during the past ten years and the increase in the capital and man-power of the industry can one help speculating on the powerful part aviation will be playing in a few years' time?

Before the war the development of the world's airways had only begun, but even so the industry employed thousands of men trained in the design, construction and operation of aircraft. Consider what the position is going to be now the war is over. The advance in Aeronautical Science made during the war years can only be guessed at, but we do know that this advance has been phenomenal. For instance, where an Atlantic crossing was still an adventure before the war, it is now an every-day occurrence. There can be no doubt about it that civil aviation will be utilized to an extent hardly dreamed about previously, and this belief is endorsed by the Government agitation that preparation on a vast scale should already be commenced for planning the airways of the world.

Here, then, is a wonderful opportunity for the man with vision and ambition to join a rapidly growing profession, which is still in its infancy. Opportunities are already there in abundance, and these opportunities will magnify, when it is a foregone conclusion that air-travel and air-transport will be on an unprecedented scale.

It cannot be too strongly stressed that aeronautical engineering, more than any other branch of engineering, demands thorough and modern technical training. Having acquired this training, many opportunities will offer themselves in one branch or other of aviation, either with an airways organization, manufacturing concern, or in the government service.

Whichever branch of aeronautics you are interested in, a study of the following pages will help you to make a right decision, knowing that the courses offered are highly efficient, thoroughly comprehensive, and—above all else—absolutely up-to-date.

B.I.E.T. Training Approved By The Royal Aeronautical Society

We are pleased to state that all our aeronautical courses have been submitted to the Secretary of the Royal Aeronautical Society, and that the courses have received the general approval and recognition of that leading Examining Body as constituting courses which are suitable for candidates for its examinations.

This recognition by the world's premier Aeronautical Society will indicate the high esteem in which our aeronautical courses are held.

Examinations Held By The Royal Aeronautical Society

Everyone who is, or aspires to be, an aeronautical engineer, should aim at passing the examinations held by this body—the premier professional examining body in this branch of engineering. It is important to note that the examinations held by this body are open, without any restriction whatever, to those desiring to specialize and qualify in aeronautical engineering.

The examinations are held annually or more frequently, as required, at centres arranged at the discretion of the Council.

Syllabus of our A.F.R.Ae.S. Course

NOTE:—*This course has been examined, approved and recognized by the Royal Aeronautical Society.*

Section "B"

1. English Essay.
2. Elementary Mathematics.

Section "A"

Either (a) Pure Mathematics or (b) Applied Mathematics.
Two subjects must be taken from the following Groups (I and II), of which not more than one may be taken from Group II.

GROUP I

(a) Strength of Aeronautical Materials and Structures.
(b) Aerodynamics.
(c) Theory of Internal Combustion Engines.
(d) Theory of Machines.

GROUP II

(a) Design (Aircraft).
(b) Design (Aero Engines).
(c) Air Transport.
(d) Aircraft Materials.
(e) Aircraft Instruments—Theory and Design.
(f) Wireless Telegraphy and Telephony and their Applications to Aeronautics.
(g) Meteorology and its Application to Aeronautics.
(h) Navigation and its Application to Aeronautics.
(i) Air Survey and Aerial Photography.

Fees

The A.F.R.Ae.S. Course is $140 cash or $160 payable $7.50 down and $7.50 a month. These fees include all the necessary textbooks, lessons, Guarantee, and intensive pre-examination coaching.

Examinations Held by the Aeronautical Inspection Directorate of the Air Ministry For the Appointment of Ground Engineers

These examinations are held by the Air Ministry for the licensing of competent persons for the inspection, etc., of aircraft. A candidate may be licensed as a Ground Engineer in any or all of the following categories:

Category "A"—Inspection of Aircraft Before Flight.
Category "B"—Inspection of Aircraft After Overhaul.
Category "C"—Inspection of Aero Engines Before Flight.
Category "D"—Inspection of Aero Engines After Overhaul.
Category "X"—Other duties which may require to be performed by a licensed Ground Engineer.

Candidates must not be less than 21 years of age. The qualifying examinations are held at various provincial centres, as circumstances warrant.

Our courses covering the Ground Engineers' Examinations have been prepared by some of the leading present day authorities, purposely to cover the examiners' requirements. The courses are, by constant revision, kept thoroughly up-to-date to meet future examination demands.

Syllabus of Examinations

Category "A"

Inspection of Aircraft Before Flight.

The general principles of the systematic maintenance and examination of aircraft before flight, including:

1. Knowledge of the methods of checking the correct assembly of components, the rigging of an erected aircraft and the functioning of the flying controls, together with the correction of faults experienced during flight.

2. For licenses to include seaplanes, knowledge of the erection, trueing up and maintenance of hulls and floats.

3. Knowledge of the defects and deterioration in wing coverings, timber members, metal fittings, propellers, stream-line wires, tie-rods, cables, that may be expected to occur as the result of fair wear-and-tear or to be produced by slight mishaps experienced during ordinary flying operations, together with the methods of effecting minor repairs and replacements.

4. Knowledge of the general principles of the installation, functioning and testing of the instruments and equipment mentioned in the Air Navigation Directions as essential equipment for the types of aircraft covered by the license.

Category "B"

Inspection of Aircraft After Overhaul.

The general principles of the inspection of aircraft construction, including:

1. Knowledge of non-metallic materials; methods of identification, examination and testing; characteristic defects which render them unsuitable; and precautions to be observed in their application to aircraft construction.

2. Knowledge of metallic materials; methods of identification, examination and testing; characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture (heat-treatment, welding, brazing, soldering, plating, etc.).

3. For licenses to include seaplane endorsements, knowledge of the methods of construction and examination of hulls and floats is also required.

4. Knowledge of the methods of construction, examination and testing of aircraft parts and components (fuselages, wings, propellers, tanks, radiators, pumps, cocks, etc.).

5. For licenses to include aircraft of all-metal construction, knowledge of the high tensile steels and aluminium alloys and the special workshop processes applicable to the materials is required.

6. Knowledge of methods of inspecting and testing the complete aircraft for correct assembly; installation of engine, controls, petrol, oil and water systems, instruments, electrical services and other appliances.

Category "C"

Inspection of Aero Engines Before Flight.

The general principles of the inspection and testing of aero-engine installation and maintenance, including:

1. Knowledge of the general construction of the particular type or types of engine for which the license is required, together with the running permissible before overhaul. The method of carrying out top-overhaul; the defects likely to be encountered and the permissible allowances for wear-and-tear. The methods of inspection and testing during the after top-overhaul to ensure correct assembly and functioning.

2. Knowledge of the methods of examination and testing of the correct erection of the power plant in the aircraft, together with characteristic installation defects in the ignition, carburation, lubrication and cooling systems and controls.

3. Knowledge of the examination and testing of the correct adjustment and functioning of the power plant after installation, and during daily maintenance, in the aircraft, including all accessories (airscrews, magnetos, carburetors, pumps, filters, pressure gauges, revolution and temperature indicators, etc.).

4. For licenses to include supercharged engines, a knowledge of the functioning of superchargers is required.

5. For licenses to include compression ignition engines, a knowledge of the fuel injection system and method of regulation is required.

Category "D"

Inspection of Aero Engines After Overhaul.

The general principles of the inspection of aero engines during construction and/or complete overhaul, including:

1. Knowledge of materials used in engine construction; methods of identification; re-examination and testing. Characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture (heat-treatment, white metalling, etc.) to ensure that the finished parts are in a satisfactory condition.
2. The general principles of brake-testing and measurement of horsepower, fuel and oil consumptions, etc., as applied to aero engines.
3. Knowledge of the general assembly, adjustment and methods of testing the correct erection of the components of the particular type or types of aero engine for which the licence is required, including the safe allowances for wear, balancing of parts, etc. The methods of adjustment, repair and testing of magnetos, carburetors, engine starters, pumps, etc., that are fitted to the particular type of engine.
4. Knowledge of the methods of inspection and testing the correct functioning of the ignition, carburation, lubrication and cooling systems on the engine during tuning up.
5. For licenses to include supercharged engines, a knowledge of the method of construction, testing, and functioning of the supercharger unit is required.
6. For licenses to include compression ignition engines, a knowledge of construction of the fuel injection system and the methods of fuel regulation is required.

Category "X"

One of the following:

(1) Inspection of electrical equipment.

(2) Aircraft instruments.

(3) Aircraft magnetos.

Any one category, $60 cash, or $75 payable by instalments of $5 on enrolment and $5 a month thereafter.

Two categories, $90 cash, or $110 payable by instalments of $7.50 on enrolment and $7.50 a month thereafter.

Three categories, $120 cash, or $140 payable by instalments of $7.50 on enrolment and $7.50 a month thereafter.

Four categories, $160 cash, or $180 payable by instalments of $10 on enrolment and $10 a month thereafter.

Five categories, $180 cash, or $200 payable by instalments of $10 on enrolment and $10 a month thereafter.

The above fees include all the necessary textbooks, lessons, Guarantee, intensive pre-examination coaching.

General Aeronautical Engineering Course

This course is notable for the wide range of its subjects. It has been carefully planned to embrace every class of worker in the aeronautical engineering industry. No student perusing the syllabus can fail to find some section which will suit his requirements. In aeronautical engineering it is however particularly useful to have as broad a knowledge as possible. For the man who wants to understand his industry in all its branches, we are offering the complete course for a very low fee indeed. We advise all students to take advantage of this generous offer.

Section "A"

1. **Practical Mathematics.**
 The course commences with a short series of lessons in this subject, written in a simple and attractive manner. The lessons are essentially of a practical type, and include only such matter as is absolutely essential for a successful study of the various branches of aeronautical engineering.
2. **Applied Mechanics.**
 Matter, force, weight, triangle and polygon of forces, structures, moments, centre of gravity, stress, strain, elasticity, tension, compression, shear, riveted joints, springs, work, energy, power, machines and mechanism, friction, velocity, acceleration, kinetic energy, horsepower, transmission of motion and power, momentum, centrifugal force. materials.
3. **Mechanics of Flight.**
 The atmosphere. The gas laws, effects of altitude troposphere and stratosphere, international standard atmosphere, the altimeter. Resistance formulae. Skin friction and eddy resistance, Bernoulli's equation, pitot tube. Units. Description and explanation of latest types of wind-tunnels, instruments used and analysis of important experiments. Aerofoil characteristic curves. Aspect ratio; the biplane. Slow-landing devices. Analysis of forces during flight in straight line and horizontal circle. Performance. Top-speed, landing and stalling speeds, rate of climb, range, endurance, time of ascent. Manoeuvres. Longitudinal, lateral and directional stability. Control at low speeds. Airscrew theories. Efficiency, torque and thrust. Stresses in airscrew blades.

Section "B"

OPTIONAL SUBJECTS.

1. **Aeronautical Structures.**
 Stress diagrams. Method of sections. Determination of C.G. Loads during manoeuvres. Design factors, load factors and safety factors. The main planes, fuselage, undercarriage, tail unit. Stress, strain. Effect of end load. Thin metal section. Elastic stability. Forces in the structure. Detail design; spars, fittings, lugs, etc. Flying boats. Wooden construction. Monocoque construction.
2. **Properties and Strength of Aeronautical Materials.**
 Structure of pure metals and alloys. Heat treatment. Alloy steels. Light alloys Mechanical properties and testing of materials. Riveted joints. Special loading cases. Torsion, springs. B.M. and S.F. diagrams. Stresses in and deflection of beams. Struts.
3. **Mechanical Drawing and Design.**
 Principles of projection according to B.S.I. practice. This course contains dozens of practical little designs, just of the type which crop up in the drawing office. The graded exercises give also excellent drawing experience. The course deals, among other things, with riveted joints, screws, threads, joints and connections, couplings, bearings, cranks and connection rods, pistons, limit gauge system, valves and valve springs, electrical details, synthetic mouldings, folded strip-metal layout, gearing, freehand sketching and isometric projection.

4. **Aircraft Inspection.**
Checking correct assembly of components. Rigging of an erected aircraft, and functioning of flying controls. Correction of faults experienced during flight. Erection, trueing up and maintenance of hulls and floats. Defects and deterioration in wing coverings, timber members, metal fittings, propellers, streamline wires, tie-rods, cables, that may be produced as a result of fair wear-and-tear or produced during ordinary flying operations by slight mishaps. Methods of effecting minor repairs and replacements. Installation, functioning and testing of instruments and equipment. Compass swinging.

5. **Aero Engine Inspection.**
Method of carrying out top-overhaul. Defects likely to be encountered. Characteristic installation defects in the ignition, carburation, lubrication and cooling systems and controls. Examination and testing of the correct adjustment of the power plant after installation. Daily maintenance of airscrews, magnetos, carburetors, pumps, filters, pressure gauges, revolution and temperature indicators, etc. Functioning of superchargers. Fuel injection systems and method of regulation of compression—ignition engines.

6. **Air Transport.**
Ground organization of aerodromes, airports, flying-boat and seaplane stations. Full treatment of aerodrome lighting, and air route lighting. Radio organization for navigational purposes, transmission and reception of meteorological information and route traffic messages. General meteorology. Effect of different types of weather on air-liners. Meteorological information. Air navigation instruments and equipment. Air traffic control. Choice of routes and of aircraft. Air legislation.

7. **Meteorology and Climatology.**
General meteorology. Winds, local and planetary. Humidity. Clouds and their formation. Rain, hail, fog, mist and snow. Coded reports. Weather maps. Synoptic charts. Air-mass systems. Fronts. Meteorological organization. Climatology. Forecasting. Instruments. Ice accretion on aircraft. Meteorological stations and their work. Special weather phenomena.

8. **Inspection of Aircraft Materials.**
This is a wonderfully comprehensive and up-to-date section, and a short description cannot do justice to it. Every phase of identification, examination and testing of all possible metallic and non-metallic materials used in aircraft is dealt with in full. The Aeronautical specifications are clearly and thoroughly explained. This subject is invaluable to designers, ground engineers and inspectors. It is preceded by a brief, lucid and elementary course on Metallurgy, for which there is no additional charge.

Fees

Minimum fee for this course, including all Section "A" and any one subject from Section "B", $110, payable by instalments of $5 on enrolment and $5 a month, or $90 cash.

Any additional subjects from Section "B" may be taken, when $30 for each additional subject will be added to the fee if paid in instalments, or $25 for each extra subject if paid cash.

Fee for Complete Aeronautical course (11 subjects), $220 cash, or $240 payable by instalments of $10 on enrolment and $10 a month.

The above fees include books, lessons, instructions, Guarantee, etc.

NOTE:—Our Diploma (A.M.I.E.T.) will be awarded to the student completing Section "A" and any one subject from Section "B".

Advanced Aeronautical Engineering and Aeroplane Design

This course has been specifically planned for the man who wishes to become a designer, a stressman or an aerodynamics specialist. It is, without doubt, the most up-to-date and comprehensive course available for the serious student. This course boldly tackles the problems which confront the designer today and scores throughout with its modern technique.

Subjects

Advanced Practical Mathematics.

Comprising higher algebra, trigonometrical equations, co-ordinate geometry, graphics, vector equations, differential and integral calculus, differential equations, etc.

Properties and Testing of Aircraft Materials.

Elements of chemistry and physics. Tension, compression, shear, fatigue, impact and surface hardness tests. Special tests for tubing, wires, ropes, timber, glued joints, rubber, fabric, etc. Classification and metallurgy of steels. Air hardening, stainless and nitriding steels. Duralumin, Y-alloy, aluminium-magnesium alloy, hiduminium R. R. alloys, M. G. 7 alloy and their uses. Aluminium welding, magnesium and its alloys, beryllium. Bearing metals. Protection against corrosion. Properties of timber and suitability for different tasks. Varnishes, lacquers and enamels. Animal hide, bone, fish and liquid glues. Casein and blood albumen cements. Braided rubber. Linen and cotton fabrics and tapes. Dopes. Fuels. Hints for designers on the use of specifications. Economics of choice of materials.

Applied Aerodynamics.

The atmosphere; derivation of equations of standard atmosphere for troposphere and stratosphere. Dimensional homogeneity of equations. Laboratory and testing apparatus, details of important experiments. Aerofoil characteristics; effects of slots, flaps, etc., polars. General theory of fluid flow; flow in tubes and between plates, eddy formation. The stream function, circulation, vorticity, conformal transformation. Dynamical similarity; model to full scale, parasite drag. Mathematics of finite aerofoil, evaluation of $\triangle_a$ and $\triangle_{kD}$. Biplane effect and induced drag, wind-tunnel interference. Performance curves; calculation of rate of climb, range of speeds, range, endurance, ceiling, and time to specified height; effect on these of wing loading, power loading, and span-squared weight ratio. Airscrews. Momentum, Drzewiecki and Inflow theories, rotational inflow, effect of body before and behind airscrew, complete strength analysis of airscrew. Equilibrium of aeroplane; loads on tail-plane and elevators. Control and manoeuvre. Spinning, autorotation. Longitudinal, lateral and directional stability, Phugoids.

Stressing and Design of Aircraft.

General problems. Weight estimation, monoplane or biplane, choice of engines, procedure. The properties of aerofoils, structural and aerodynamic consideration of variation in upper and lower surface camber, effect of C.P. travel. The slotted flap, zap flap, slotted wing, wing-tip rotor, etc. Effect of aspect-ratio, biplane interference, gap, stagger, decalage, etc. General layout of aeroplane. Data for design calculations. Equivalent plane, factors of safety and loading; estimation of factors during manoeuvres. Use of aircraft specifications. Stressing of structures. Redundant frames. Stresses in bowed and eccentric slim struts; solid, hollow, tapered and built up. Stresses in beams. Polar diagrams; beams with end load. Stresses in wing structures, secondary failure. Main wing trusses, ribs, drag bracing, lift wires, drag struts. Elastic stability. Fuselage design, different types under different conditions. Undercarriage. Tail-plane, fin and rudder, ailerons. Mass and aerodynamic balance, float seaplanes and flying boats. Designs of control system. Riveting. Design of details. Rapid estimation of performance. The power unit. Experimental testing of aircraft structures and parts.

Fees

The fee for the complete course, including all textbooks, lessons, unlimited tuition, and the award of our Diploma, is $140 cash, or $160 payable $10 on enrolment and $5 a month.

Aero Engines Course

In the whole of the aircraft industry there is no branch requiring more specialized knowledge than aero engines. The extraordinary high standards of efficiency demanded are unique in engineering. British aero engine technicians may well be proud that, even in these days of fierce competition, they lead the world. It is in this tradition that we offer this course on the design, construction, operation and maintenance of modern power units. Although our course is thoroughly comprehensive, we commence from first principles, with basic instruction in mathematics and mechanics, thus rendering the profession open to all.

Subjects

Practical Mathematics

The course commences with a series of lessons in practical mathematics, written in a simple and attractive manner. The lessons commence with first principles of arithmetic, if necessary, and include algebra, logarithms, mensuration, trigonometry.

Applied Mechanics (including Strength of Materials)

First principles, triangle and polygon of forces, moments, centre of gravity, couples, link polygon, strain and elasticity, shafts, springs, strength of materials, work, energy, power, machines, dynamometers, friction, velocity and acceleration, inertia, kinetic energy, centrifugal force, link mechanism, flywheels, gearing, hydraulics.

Thermodynamics.

Gas laws, laws of thermodynamics, analysis of various theoretical and practical cycles of operation, including those of the two-stroke and four-stroke diesel, semi-diesel and gasoline engines. Volumetric efficiency and the effects of altitude, mixture strength, variation of speed, valve timing and throttling thereon. Full treatment of pre-ignition, auto-ignition and detonation, with descriptions of modern theories for their occurrence.

General Design.

Calculation of the bearing loads and stresses due to the varying gas pressure in the cylinder and to the inertia of the moving parts. Interpretation of diagrams of valve opening. Method of obtaining torque diagrams. Simplified treatment of the torsional vibrations of shafts. Air, liquid and evaporative cooling systems fully discussed and design data explained.

Aero Engine Materials.

Specifications of materials used in aero engine design, and how to use them. Materials for pistons, bearings, valves, crankshafts, connecting rods, gears, crankcases, cylinder heads, superchargers, transmission couplings and engine mountings. The most modern steels, light alloys, synthetic mouldings and special alloys are enumerated and their special properties described. Heat treatment and mechanical conditioning of materials for special tasks.

Fuels.

Origin of fuels. Different types and their composition. Cetene and octane numbers. Fuel systems. Lubricating oils and lubricating systems. Testing of fuels to withstand various severe requirements. Special diesel fuels. Viscosity. Oil coolers.

Types of Engine.

Poppet valve engines. Sleeve valve engines. Engines having one or more straight rows of cylinders. Radial engines with one or two crankshafts. Axial engines. This course includes a detailed description of the parts and functioning of the latest designs of Bristol, Armstrong, Siddeley, De Haviland, Napier, Rolls-Royce, etc. Suitability of different engines for special tasks examined.

Engine Details.

Valves. Pistons. Connecting rods. Water pumps. Fuel pumps. Engine starters of various types. Centrifugal superchargers. Rotar and eccentric vane types of superchargers. Speed reduction gearing. Airscrew hubs. Carburetors. Magnetos. Sparking plugs. Crankshafts. Descriptions, desirable qualities. Design data.

Installation.

This, the most comprehensive section, deals with the installation, operation, inspection, maintenance and overhaul of the latest aero engine models. The items are dealt with in a thoroughly practical manner, and incorporate knowledge acquired over years of experience. This section alone renders the course a necessity for all those concerned in the industry.

Testing.

Measurement of power by means of torque reaction of engine dynamometer. Hydraulic, electrical and air brake and airscrew dynamometers. Correction of power for atmospheric conditions. Estimation of performance of supercharged engines at altitude from tests taken at ground level. Measurement of heat balance. Measurement of fuel and oil consumptions.

Fees

The complete fee for our Aero Engines course, including all textbooks, lessons, unlimited tuition, Guarantee, and the award of our Diploma, is $90 cash, or $110 payable $7.50 on enrolment and thereafter $7.50 a month.

Pilots' "B" License

Good commercial pilots are now in demand and, with aviation developing as it is at the present time, the number of remunerative positions available for those who hold the necessary qualifications will continue to increase.

Before a person may fly an aeroplane engaged in Commercial Transport (i.e., carrying passengers and/or goods for hire or reward), it is necessary, under Air Ministry Regulations, that he or she should obtain a "B" License. The syllabus for the theoretical examination for this license, which is an extensive one, is completely covered by our course.

Subjects

1. **Practical Mathematics.**

This course includes those branches of mathematics which are applicable to the theoretical studies associated with the "B" license and necessary for the solution of practical problems. The lessons embrace arithmetic, algebra, mensuration, logarithms, trigonometry.

2. Navigation.

Definitions of terms used in navigation. Map projections. Properties and use of maps and charts. Conventional signs used on maps and charts. The triangle of velocities and practical use. Calculating instruments. Position lines and fixes. Properties of loop aerials. Direction finding systems and their use. Elementary laws of magnetism. Construction of aircraft compasses. Causes of deviation. Calculations of coefficients. Precautions before swinging compasses. Swinging compasses. Occasions when to swing compasses. Behaviour compasses during change of speed and course. Properties of the gyroscope. Gyroscopic compasses. Directional gyroscopes. Turn indicators. Altimeters. Rate of climb indicators. Automatic pilots.

3. Meteorology.

The observations made at fully equipped meteorological stations and the instruments used. Method of coding the information. Collection of coded messages. Hours of collection. Reciprocal broadcasting scheme. Physical explanation of the meteorological phenomena. Barometric pressure. Winds. Temperature lapse rates. Clouds. Fog. Rain. Snow. Hail. Thunderstorms. Ice accretion on aircraft. Dangers to aircraft. Construction of weather charts. Types of pressure systems. Polar front theory. Warm, cold and occluded fronts. Warm sector. Weather associated with pressure systems. Upper air information. Weather reports and forecasts. Dissemination of meteorological information. Regional scheme.

4. Legislation.

The International Convention for Air Navigation. The Air Navigation Acts. The Carriage by Air Act. The International Aerial Sanitary Convention. The Air Navigation Orders. The Air Navigation Regulations. The Air Navigation Directions. The Foreign Air Regulations Handbooks. The Air Pilot. Notices to Airmen.

5. Aircraft Construction.

Elementary aerodynamics. Properties of wings. Stability. Control. Slots. Flaps. Airscrews. Action of the controls. Forces acting on the aircraft during normal manoeuvres. Construction of fuselages, wings, stabilizing surfaces, control surfaces, and undercarriages. Petrol systems. Lighting systems. Loading of aircraft. Range. Assembly of aircraft.

6. Aero Engines.

Principles of I.C. engines. Metals used in construction. Functions of parts. Ignition system. Carburation. Lubrication system. Timing of valves and magneto. Running faults. Methods of engine starting. Cooling systems. Revolution indicator. Oil pressure and temperature gauges. Mixture analysers. Supercharging. Boost gauges.

Fees

The complete fee for our Pilot's "B" License Examination course, including all text-books, lessons, unlimited tuition, Guarantee, and intensive pre-examination coaching, is $170 cash, or $190 payable $10 on enrolment and thereafter $10 a month.

Air Ministry Air Navigators' Certificates

Any commercial aircraft used for the international carriage of passengers or goods must carry a person duly qualified as a navigator. In craft carrying over five persons, there must be both a pilot and a navigator appropriately qualified.

There are two certificates. The Second Class Certificate is essential in the case of such craft flying (a) more than 100 miles over inhabited regions or more than 100 miles but less than 625 miles entirely over high seas or uninhabited regions; or (b) by night, more than 16 miles but not more than 625 miles.

The First Class Certificate is essential in the case of craft flying more than 625 miles over high seas or uninhabited areas or by night more than 625 miles.

Our courses covering the Air Navigators' Certificates have been prepared by authorities closely in touch with the Air Ministry requirements, and provide that specialized guidance which is so essential to early examination success.

Syllabus of Examinations

SECOND CLASS CERTIFICATE.

1. **International Air Legislation.**
 Detailed information on the application and practical use of the standard publications; clear explanation of regulations.

2. **Form of the Earth; Maps and Charts.**
 Explanation of terms used. Determination of sunrise, sunset, moonrise and moonset. Sexagesimal co-ordinate system. Calculation of course and distance by Mid. Lat. and Mercatorial formulae. Measurement of time. Location of heavenly bodies. Mercatorial gnomonic and other common projections explained. Plotting of bearings. Preparation of maps for flight.

3. **Meteorology.**
 General meteorology. Winds, local and planetary. Humidity. Clouds and their formation. Rain, hail, fog, mist and snow. Coded reports. Weather maps. Synoptic charts. Climatology. Forecasting. Instruments. Ice accretion on aircraft. Meteorological stations and their work.

4. **Dead Reckoning and Radiogoniometry.**
 Course, track, drift. Measurement and calculation of air and ground speed. Triangle of velocities. Interception. Determination of position. Description of radiogoniometrical systems. Causes of error. Position lines and fixes. Convergency of meridians.

5. **Earth's Magnetism; Compasses.**

Earth as a magnet. Dip. Variation. Principles of construction of compasses; care and maintenance of standard types. Causes and effects of deviation. Determination of deviation by means of Amplitude and Azimuth tables. Evaluation of coefficients. Compensation for A, B and C. The Micro-Adjuster. The Deviascope. Northerly turning error. Acceleration errors.

FIRST CLASS CERTIFICATE.

The First Class syllabus includes that for the Second Class, but certain sections are elaborated and much additional matter is necessary. This is outlined below.

1. **International Air Legislation.**

More detailed than for Second Class.

2. **Form of the Earth; Maps, Charts and Tides.**

Spherical trigonometry. The Sailings—parallel, mercatorial, great circle and composite. Principles of construction and uses of the following projections: Polar Gnomonic, Equatorial Gnomonic, Mercator's, Stereographic, Simple conic, Conic with two standard parallels, Bonne's, Gauss' Conformal, Cassini's Polyconic. The construction of the graticule is fully explained. Tidal theory. Tidal prediction, including use of harmonic constants. Definitions and explanations of terms employed.

3. **Meteorology.**

Air-mass systems. Fronts, Meteorological organizations. Average conditions over world and special weather phenomena.

4. **Dead Reckoning and Radiogoniometry.**

More difficult problems set.

5. **Earth's Magnetism; Compasses.**

Calculation of deviation from approximate coefficients for any course. Change in deviation with latitude. Principles of design of compasses.

6. **Astronomical Navigation.**

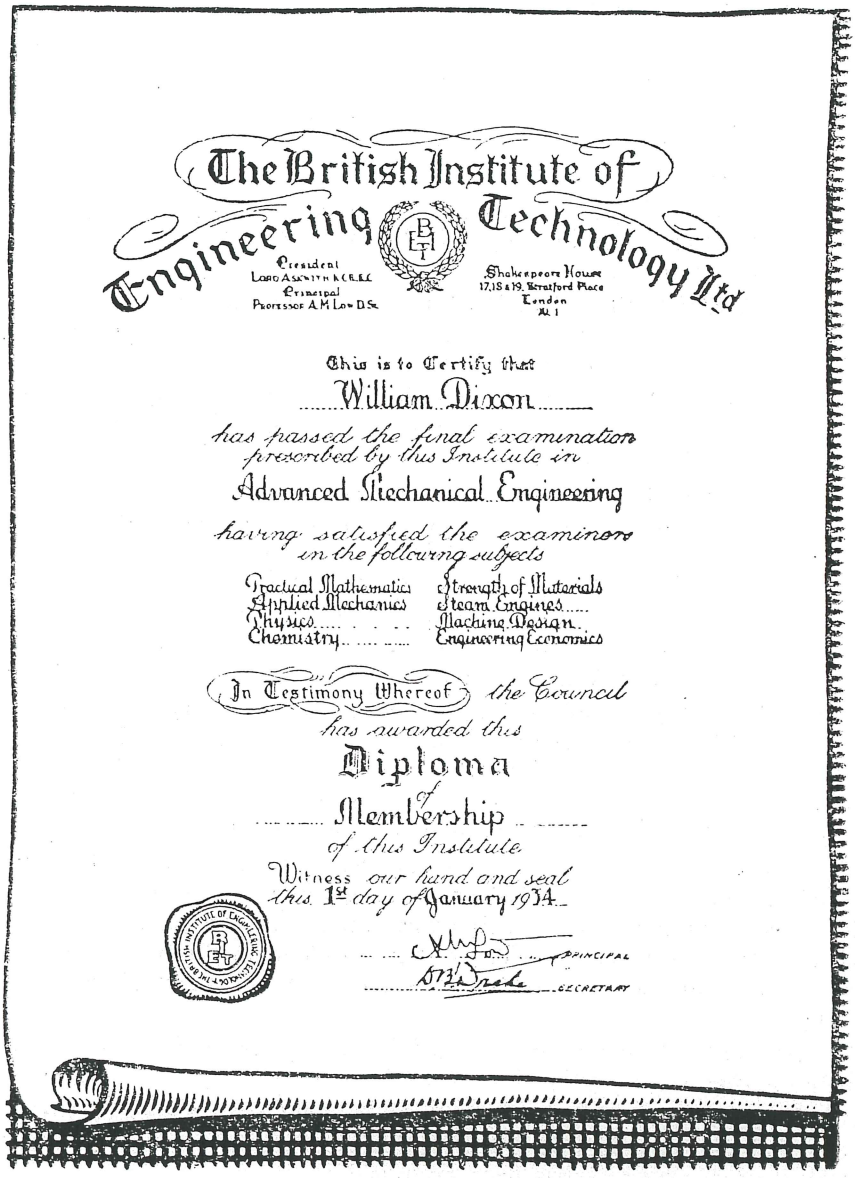
The solar system. Designation, recognition and position of heavenly bodies. Time. Position lines and calculation of fixes therefrom. Use of special tables and star-charts. Care and use of instruments. Definitions and explanations of terms employed.

Fees

The complete fee for our course covering the Second Class Air Navigators' Certificates, including all textbooks, tables, regulations, lessons, unlimited tuition, etc., is $120 cash, or $140 payable $5 on enrolment and $5 a month.

The fee for the course covering the First Class Certificate is $140 cash, or $160 payable $10 on enrolment and $5 a month.

The fee for the two courses combined is $220 cash, or $250 payable $10 on enrolment and $5 a month.



The British Institute of Engineering Technology Ltd

President
Lord Ashcroft K.C.B.E.C.
Principal
Professor A.M. Low D.Sc.

Shakespeare House
17, 18 & 19, Stratford Place
London
W.1

This is to Certify that

William Dixon

has passed the final examination prescribed by this Institute in

Advanced Mechanical Engineering

having satisfied the examiners in the following subjects

Practical Mathematics	Strength of Materials
Applied Mechanics	Steam Engines
Physics	Machine Design
Chemistry	Engineering Economics

In Testimony Whereof the Council has awarded this

Diploma

of

Membership

of this Institute

Witness our hand and seal this 1st day of January 1934

PRINCIPAL

SECRETARY

MINIATURE FACSIMILE

Regulations Governing Membership of This Institute

(1) The British Institute of Engineering Technology consists of:

Members. Associate Members. Students.

(2) The following abbreviated titles may be used:

Students	**Stud.I.E.T.**
Associate Members	**A.M.I.E.T.**
Members	**M.I.E.T.**

(3) A STUDENT is any person who has been officially enrolled for any course of instruction prescribed by this Institute and is pursuing his studies with reasonable diligence.

(4) AN ASSOCIATE MEMBER is a person who has either:

(a) Completed to the satisfaction of the Board any one of our general courses of instruction.

(b) Has passed an examination prescribed by this Institute based on the syllabus of any one of our general courses of instruction.

(5) A MEMBER is a person who has either:

(a) Completed to the satisfaction of the Board any one of the following courses—A.M.Inst.C.E., A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., and similar Major Professional Examinations.

(b) Has passed an examination *prescribed by this Institute* based on our A.M.Inst.C.E., A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., and similar courses.

It should be clearly understood that it is not necessary actually to pass the A.M.Inst.C.E., A.M.I.Mech.E., A.M.I.E.E., or A.F.R.Ae.S. Examination in order to qualify for Membership of *this* Institute. It is sufficient for the candidate to have satisfied *us* as to the standard of his knowledge of the subjects included in any one of these Examinations.

(6) *Students* are allowed to study at their own rate and are entitled to all privileges of Membership. Their courses must, however, be completed within a period of five years. This understanding is necessary to restrict the period of our responsibility. The average student can complete his course in one to two years, and accordingly the period of five years allowed is more than ample.

(7) *Associate Members and Members* are recognized as such by this Institute for life.

(8) The Institute will issue to each Member and Associate Member a Diploma showing the class to which he belongs, and stating the subjects he has studied or in which he has been examined.

(9) Each student will receive a certificate testifying that he is an official student of this Institute and stating the course for which he is enrolled.

(10) Where students elect to pay their fees on the instalment basis, such instalments will become due and payable on the first day of each month.

EVIDENCE

Read this section giving excerpts from a few of the thousands of letters received, as well as other testimony—ample evidence of the work and aims of the Institute and its record of successes.

CANADIAN INSTITUTE OF SCIENCE & TECHNOLOGY, LIMITED

219 BAY STREET - TORONTO, CANADA

North American Headquarters for the

B.I.E.T.

(British Institute of Engineering Technology.)

December 1st, 1940 Regina, Saskatchewan

"Since that time I have gained considerable experience in the aircraft industry and with the aid of your correspondence course, obtained my 'A' and 'C' licenses."

* * *

December 4, 1940 Bowsman River, Man.

"From what I have seen of your system, I can say it is very concise and easy to understand. I have had much to do with students in correspondence courses and I can personally recommend your system."

* * *

May 26th, 1941 Shiela, New Brunswick

"I am studying every night and I like the course very much. It is so interesting and so easy to learn; everything is so well explained that everybody that can read will understand it."

* * *

May 12th, 1941 Vancouver, B.C.

"The service I have received from you in the past has been of the best and I haven't hesitated to recommend your course to several prospective pupils."

* * *

January 8th, 1941 Port Dalhousie, Ont.

"May I say at this time that I am benefitting a great deal from this course. I am an aircraft inspector and see many of these principles in actual use, incorporated in aircraft components."

* * *

February 10th, 1941 Windsor Mills, Que.

"I always have my books at hand and use them very often for my work. I am very glad I took this course as I am anxious to learn more."

* * *

May 18th, 1941 Peterborough, Ont.

"I wish to thank you for placing me in my new position. It is a very large company and there are excellent possibilities in it for trained men."

February 6th, 1941 Winnipeg, Man.

"I have received a promotion at work with shorter hours and lighter work so this will give me more time for studying. I am pleased to see my course proving its worth in such early stages."

* * *

June 5th, 1941 Paterson, New Jersey, U.S.

"I find a lot of the aircraft section useful to me in my work."

* * *

June 15th, 1941 Ottawa, Ont.

"May I thank you and your fellow officers of the school for the considerate treatment of my problems that you have accorded me in the past."

* * *

January 20th, 1941 Hamilton, Ont.

"I am very pleased to announce that I have obtained a position with a large company here in Hamilton through my connection with your school and have started work today. It is certainly encouraging for me to start in this new position with the high recommendations from your school and I will do everything in my power to uphold the workmanship of your scholars."

* * *

January 31st, 1941 Windsor, Ont.

"Your drafting and machine design course has helped me a great deal in my tool making studies. I get all the drafting assignments for drawing up new work for the class."

* * *

February 2nd, 1941 Toronto, Ont.

"I wish to express my appreciation for the assistance in procuring for me the position. I hope that I will be able to fulfill my obligations and be a credit to the British Institute of Engineering Technology."

* * *

June 4th, 1941 Montreal, Que.

"I am so pleased with my course that I cannot help recommending your school every time I have an occasion to do so."